Non-HDL Cholesterol and Type 2 Diabetes Mellitus

*S Zabeen[1], MR Rahman[2], TG Mustafa[3], NH Eusufzai[4], S Shermin[5]

[1]*Dr. Shahana Zabeen, Dept. of Biochemistry, AKMMC.*
[2]*Dr. Md. Rezwanur Rahman, Dept. of Biochemistry, Delta Medical College. Dhaka.*
[3]*Dr. Tarek Golam Mustafa. MD (Resident) Dept. of Pharmacology. BSMMU. Dhaka.*
[4]*Dr. Nazmul Haque Eusufzai.Senior Medical Officer,OPD. BIRDEM.Dhaka.*
[5]*Dr. Shahana Shermin. Senior Medical Officer, Dept. of Gynae & Obs. BIRDEM, Dhaka.*

* Corresponding Author

ABSTRACT

Non-High density lipoprotein cholesterol reflects total cholesterol minus HDL cholesterol and encompasses all cholesterol present in potentially atherogenic lipoprotein particles. It has been recently suggested that Non-HDL cholesterol might be a useful marker and a better predictor of atherosclerosis in type 2 diabetic subjects. The study was designed to explore the role of non-HDL cholesterol in diabetic population. It was a case-control study. 150 subjects irrespective of sex were selected. Of them 103 were diabetic and 47 were non-diabetic. The lipid profile including total cholesterol, TG and HDL-C were measured following standard method & procedure. LDL-C was calculated using Friedwald's formula. TG concentration of > 400 mg/dl were excluded from the study. Non HDL-C is calculated by subtracting the level of HDL cholesterol from total cholesterol. Unpaired t test and chi square test were done to find out the level of significance. Non-HDL cholesterol was compared between the study groups and significant differences were observed (p value < 0.001). Non-HDL cholesterol is elevated in type 2 diabetes mellitus and therefore should perform as a routine assessment in all diabetic subjects.

Key word: Non-HDL-C (Non-HDL cholesterol), TGRLP (Triglyceride rich lipoproteins), Type 2 Diabetes.

Introduction

A standard lipid profile consists of total cholesterol (TC), HDL-C, LDL-C and triglycerides (TG)[1]. Although levels of LDL cholesterol are the primary focus of dyslipidaemia screening, in diabetic people but relying on LDL targets alone can be misleading in such patients since they produce highly atherogenic VLDL and IDL lipoproteins as well as small dense atherogenic LDL particles, in spite of normal LDL values[2]. It is now clear that LDL is not the only atherogenic lipoprotein but apoprotein-B containing particles, such as VLDL, IDL and chylomicron remnants are also potentially atherogenic[3]. So, researchers have looked at other measurements that can help them to identify the diabetic people who are at increased risk of atherosclerosis[4].

Non-HDL cholesterol (non HDL-C) is such a marker that is obtained by subtracting the level of HDL cholesterol from total cholesterol[5]. The resulting value measures not only LDL cholesterol but also other apoprotein-B containing particles, such as VLDL, IDL and chylomicron remnants[3]. Although apo-B can be assessed directly but its measurement is not widely available in commercial laboratories1. But measurement of non HDL-C is more practical, simple, reliable, and inexpensive and is accepted as surrogate marker for apo-B in routine clinical practice[6]. Unlike LDL cholesterol, which can be incorrectly calculated in presence of postprandial hypertriglyceridemia, (and require fasting sample) non HDL-C is reliable when measure in non-fasting state[7].

As LDL is the primary carrier of cholesterol in plasma, VLDL and IDL are the main carriers of TG[7]. These TG rich lipoproteins (TGRLPs) also carry cholesterol[8]. In the presence of hypertriglyceridemia, TGRLPs may be partly depleted of their TG content and become enriched with cholesterol from LDL. The modified remnant lipoproteins that result are believed to be highly atherogenic because of their small size, high cholesterol content and increase residence time in plasma[9]. They are able to deliver more cholesterol to macrophages than LDL particles because they can penetrate the arterial wall with ease, be taken up directly by macrophages, and participate in foam cell formation, thus initiating the lipid laden plaque[10].

At the same time, LDL exchanges core lipids with VLDL to become TG rich and undergoes lipolysis, resulting in a smaller and denser LDL particle[11]. These compacted lipid depleted LDL particles are more atherogenic because they are more easily oxidized and readily penetrate the artery wall. However, even though small dense LDL particles are greater in both number and atherogenesity than normal-sized LDL, LDL cholesterol level appears normal rather than high on standard measurements because small dense particles are lipid poor[12].

Therefore, the measurement of LDL cholesterol alone may not always provide sufficient measure of atherogenic risk in subjects with type 2 diabetes mellitus. As the measurement of non HDL-C is simple and can be calculated after a standard cholesterol test, so, measuring non-HDL cholesterol can be useful in assessing their risk and guiding their treatment strategy[13]. Target goals for LDL and non HDL-C in patients with diabetes are <100 and <130 mg/dl[7].

Method

It was a case control study carried out in the Department of Biochemistry, Anwer khan Modern Medical College (AKMMC). One hundred and fifty patients (150) irrespective of sex were selected purposively from OPD, BIRDEM and Anwer khan Modern Medical College Hospital (AKMMCH). Of them 103 were diagnosed type 2 DM taken as case and 47 were

non-diabetic were control. The lipid profile including total cholesterol, TG and HDL-C were measured following standard method & procedure. LDL-C was calculated using Friedwald's formula. TG concentration of >400 mg/dl were excluded from the study. Non HDL-C is calculated by subtracting the level of HDL cholesterol from total cholesterol. Relevant statistical tests were done in SPSS 12.0 version (p value <0.05 was taken as lowest level of significance).

Results

Table 1 show the distribution and comparison of age and sex of the study subjects out of 103 diabetic subjects number of male subjects was 70 and that of female was 33. On the other hand 26 were male and 21 were female in total 47 non diabetic subjects. Mean age of the diabetic and non diabetic subjects were 46.53 ± 5.43 years with range of 39-62 years and 47.38 ± 7.61 years with range of 32-62 respectively. There was no statistically significant difference regarding age and sex between the groups (p > 0.05).

Table 1: Distribution & comparison of age & sex of the study subjects

Group	Sex		x^2 / p	Mean age ± SD (yrs) (Range)	t / p
	Male	Female			
Diabetic (n=103)	70	33	1.72 / 0.146	46.53 ± 5.43 (39 -62)	-0.69 / 0.49
Non diabetic (n=47)	26	21		47.38 ± 7.61 (32 -62)	

Mean TC, TG, HDL-C and LDL-C (in mg/dl) in diabetic subjects were 219.78 ± 41.74 (range 102-319), 265.53 ± 67.58 (range 120-400), 38.23 ± 7.56 (range 30-88) and 129.37 ± 39.22 (range 26-206) respectively and in non diabetic subjects these were 178.38 ± 38.24 (range 99-262), 165.74 ± 69.85 (range 75-323), 36 ± 8.64 (range 18-58) and 108.89 ± 31.71 (range 51-179) respectively. Except HDL-C (p >0.05) other three components of lipid profile were significantly higher in case group i.e. in diabetic subjects (Table 2).

Table II: Distribution & comparison of lipid profile between diabetic & non diabetic subjects

Components of lipid profile in mg/dl	Grouping of study subjects		t-value	p-value
	Diabetic(n=103)	Non diabetic(n=47)		
TC (Mean±SD)	219.78 ± 41.74 (102-319)	178.38 ± 38.24 (99-262)	5.78	0.000
TG (Mean±SD)	265.53 ± 67.58 (120-400)	165.74 ± 69.85 (75-323)	8.30	0.000
HDL-C (Mean±SD)	38.23 ± 7.56 (30-88)	36 ± 8.64 (18-58)	1.53	0.131
LDL-C (Mean±SD)	129.37 ± 39.22 (26-206)	108.89 ± 31.71 (51-179)	3.14	0.002

Table III: Distribution & comparison of non HDL-Cholesterol between diabetic & non diabetic subjects

Grouping	Non HDL-C in mg/dl (Mean±SD)	t-value	p-value
Diabetic (n=103)	181 ± 40.11 (71-276)	5.73	0.000
Non diabetic (n=47)	142.47 ± 36.27 (68-219)		

Table III shows mean non HDL-C (in mg/dl) in case and control which reveals significantly very high difference between the groups [181 ± 40.11 (range 71-276) vs. 142.47 ± 36.27 (range 68-219); p <0.001].

Discussion

In this case control study our attempt was to explore the role of non HDL-C in diabetic population. Our study revealed that non HDL-C is significantly higher in diabetic subjects than non diabetic subjects. Our finding is similar to the findings of Abbasi et al 2007, Pinto et al 2007 and Peters AL 2008. They suggests that though the LDL, the main cholesterol bearing lipoprotein is major determinant of atherosclerosis in patients with diabetes but elevated VLDL is also associated with increase in prothrombotic and procoagulant factors and inclusion of VLDL is easily possible by determining non HDL-C.

The adult treatment panel III of National Cholesterol Education Program (NCEP) emphasizes the need of for optimization of LDL cholesterol levels, but it has been recently recommended that non-HDL cholesterol may be a better predictor of atherosclerosis in Type 2 DM[14]. NCEP also recognized the significance of non- HDL cholesterol in diabetes and considered it to be a secondary therapeutic target; nevertheless, LDL- cholesterol is defined as the main therapeutic target in the management of diabetic dyslipidaemia[15].

In systolic hypertension elderly program (SHEP) non HDL-C is elevated in both diabetes and hypertensive individuals[16]. Our data was in agreement with this study also. The Strong Heart Study determines whether non HDL-C, is a predictor of CVD in patients with diabetes. This study suggests that non HDL-C index may be particularly useful in predicting CVD risk in patients with diabetes[17]. Because diabetic patients are high risk for CVD morbidity and mortality, adequate risk assessment and management is imperative. Within the realms of standard lipid profile, non HDL-C appears to be the parameter correlating best with apo-B the most atherogenic lipoprotein[15].

As people with type 2 diabetes often have elevated triglyceride level but relatively normal LDL-C value, so measuring their non HDL-C can be useful in assessing their risk of atherosclerosis and guiding their treatment. One advantage of factoring in non HDL-C is that it requires no additional testing; it simply can be calculated after a standard cholesterol test.

Conclusion

Non-HDL cholesterol can be useful in assessing the risk of atherosclerosis in type 2 DM therefore it should be included in lipid profile for assessing their risk and guiding treatment.

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